

Space Weather Technical Forecast

Issued on Thursday, 10 August 2023 at 01:15 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Minor ongoing solar radiation storm, S1 waning. Slight chance of M-class flares (R1-R2; Minor-Moderate radio blackouts) throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is Low, with a C5.1 originating from ex-3387 at 09/0701 UTC, which has now rotated around the northwest limb. There are currently six sunspot regions on the visible disc, with the majority of the regions stable and unipolar, else bipolar and in decay, with little overall change observed in the past 24 hours. AR3387 has now rotated around the northwest limb, and had a Dsi/Beta-Gamma configuration, it follows close behind ex-3386, with some magnetic connection appearing over the limb. Both AR3395 in the northeast and AR3394 in the southwest, have both shown some minor changes in periphery spots and pores surrounding the penumbral central spots.

A plasma eruption which occurred at 09/1530UTC on the western limb was followed by a partial halo CME (seen in coronagraph imagery from 09/1620 UTC). This is currently undergoing analysis for any potential Earth-direct component, although this feature does appear to be far-sided - pending analysis.

Otherwise, no Earth-directed CMEs have been observed in available coronagraph imagery in the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured at L1 by ACE and DSCOVR started the period at slightly elevated levels, around 480km/s, gradually declining to background levels, near 380km/s at present. Solar density has been mostly average, before rising to above average from 09/1540 UTC, peaking at 15 ppcc, before a gradual decline back to average values from 09/2000 UTC. The IMF has been weak, peaking at +7nT, with the all important north-south component (Bz) varying between +6 and -4nT. The phi angle started the period mostly positive (away from the Sun), before re-orientating to become mostly negative (towards the Sun) from 09/0500 UTC. The net effect of the above solar wind parameters was for Quiet geomagnetic conditions (Kp1-2).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10 MeV) proton flux showed a response to the X1.5 flare peaking at 07/2046UTC from Ex-AR3386 (which as now rotated beyond the NW limb) with observed levels remaining above the S1 Minor Solar Radiation storm threshold and reaching 47 pfu at 09/0025 UTC. High energy (greater than 2MeV) electron flux was initially at background levels, rising to Moderate to High levels, with a peak of 1772 pfu at 09/1730 UTC, during its diurnal cycle. The associated 24-hour integrated fluence remained well below the Active level (1e8 integrated pfu), with 4.61e7 integrated pfu recorded at 10/0001UTC with a rising trend.

Four-Day Space Weather Forecast Summary

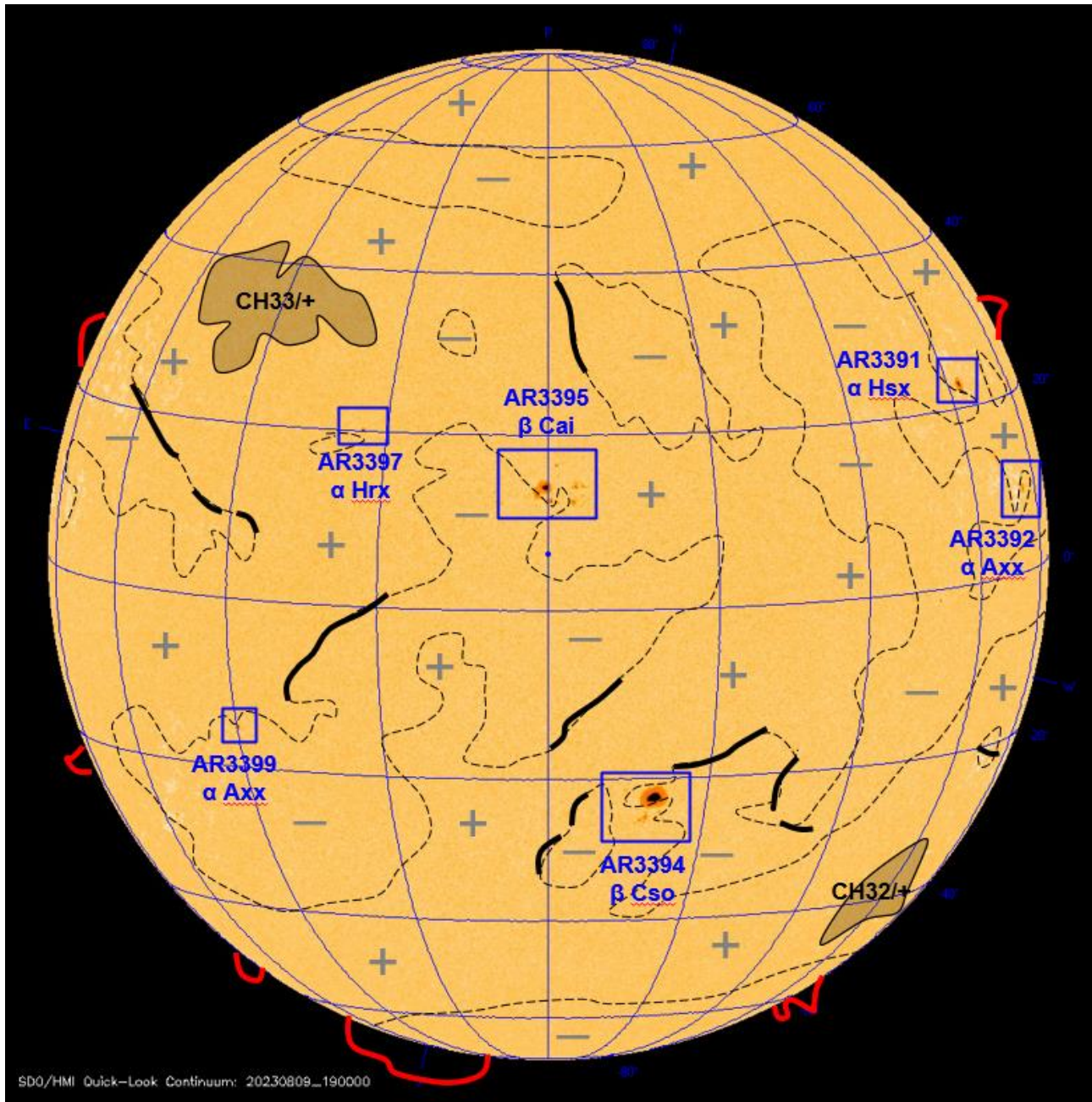
Solar Activity: Low levels of solar activity are anticipated, with only a slight chance of further M-
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class flares. The greatest risk for this occurring is probably from AR3395 currently near centre-disc, with any further daily additional contribution from regions arriving from around the eastern limb.

Solar Wind / Geomagnetic Activity: No coronal hole high speed streams (HSS) winds feature in the forecast, and there have been no new modelled Earth-directed CMEs in the past 24 hours. Geomagnetic activity is likely to be mostly Quiet (Kp 0-2) throughout the period.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux should show a decreasing risk of further breaches of S1 as the primarily responsible region rotates further around the far side, falling from Expected to a near background. Slight Chance by the second half of the current UTC working week. The high energy (greater than 2 MeV) electron flux carry a daily Chance of reaching High levels. The associated fluence is expected to remain below Active, with a probable flat or weakly rising trend.

Figure 1. Solar Analysis Valid 09/1900 UTC.



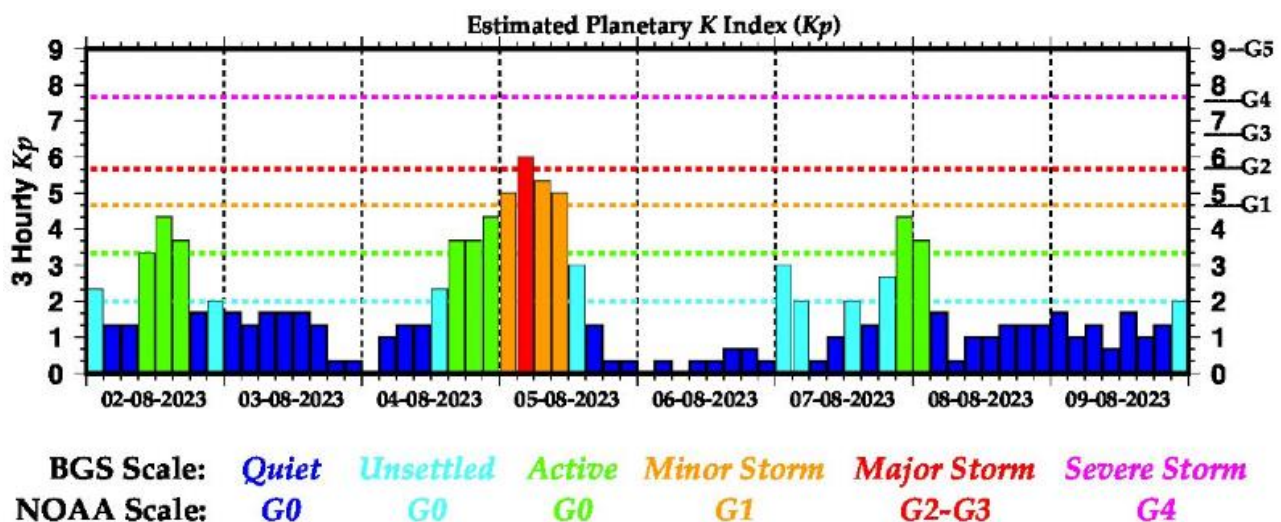
Key: Filament — , Prominence — , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - γ - δ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

No significant coronal hole fast winds (HSS) are likely for the coming four days, with no further Earth-directed CMEs currently in the forecast. As a result, geomagnetic activity is likely to be Quiet throughout.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: BGS Estimated Planetary K Index (Kp)

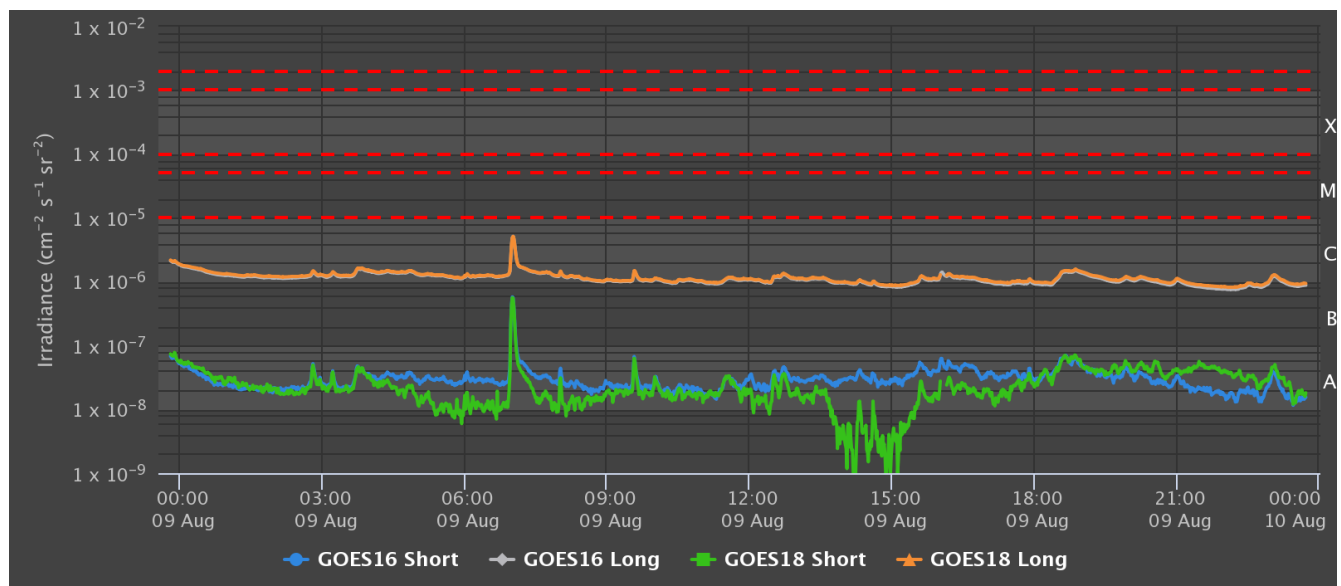


Radio Blackouts - X-Ray Flares:

There are currently six sunspot regions on the visible disc. Most of the groups on the disc are either unipolar or else simple dipoles with stable or fading tendencies. AR3394 and AR3395 both show some minor changes in the periphery pores and spots. Solar activity is Low and AR3395 is probably now the main risk for any isolated M-class flares. This risk receding towards raw values in the coming days. Any additional risk contribution from the eastern limb remains to be seen and some brightening in magnetic flux is quite evident on the northeast limb with an active region probably appearing in the coming 24 to 48 hours.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	20	20	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16/18 X-Ray Flares.



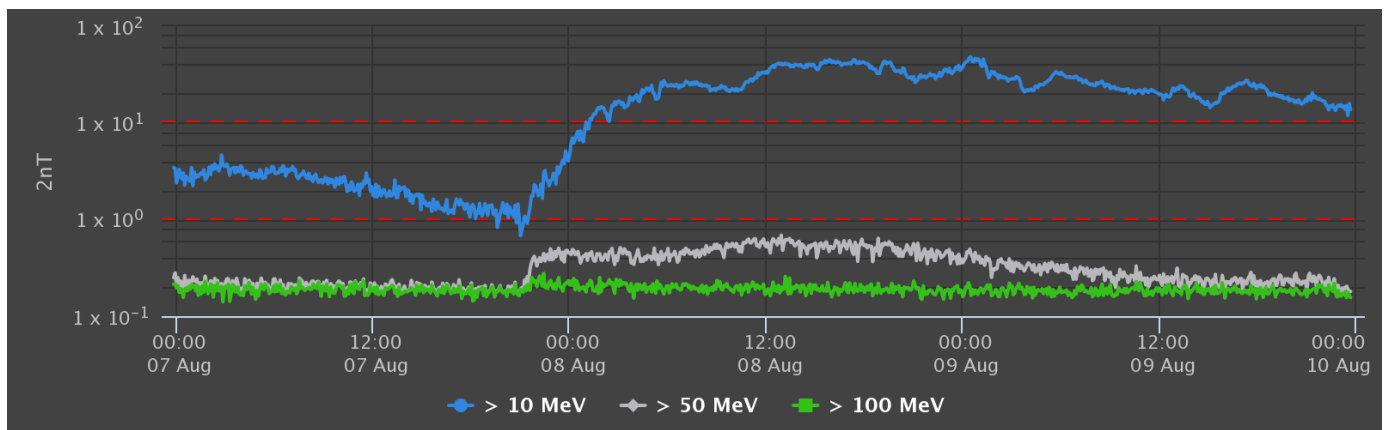
Solar Radiation Storms - (High Energy Protons):

Further flares from Ex-AR3386 and possibly Ex-AR3387 (both rotated off the NW limb now) could keep solar radiation levels above the S1 minor storm threshold during day 1 (10 Aug) before the active regions rotate away sufficiently far round the far-side to limit the risk of further notable proton enhancements. Solar radiation storms at the S1 level are likely to remain ongoing for the coming twelve hours but the risk should lower to a Slight Chance by Day 2 (11 Aug) as the regions responsible rotate further from view.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	Yes	100	50	10	5
Very Active	$\geq \text{S3}$ *	No	5	1	1	1

* $\text{S3} \geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)

Figure 4: GOES-16 Proton Flux – shows above the S1 threshold since 08 August after recent X and M-class flares from regions ex-3386 and ex-3387 (these have now rotated around the northwest limb).



High Energy Electrons Event ($\geq 2\text{MeV}$):

The high energy electron flux (greater than 10 MeV) observed by GOES16 has shown a slight recovery over the past 48 hours, however with no further significant HSS expected, only a modest flux rise during the diurnal cycle is expected, and probably reaching the daily high flux threshold. Overall, the associated 24-hour integrated fluence is likely to stay below the Active level, albeit with a slightly rising trend. The Met Office REFM guidance is considered to be providing useful guidance with little overall change likely, although the fall indicated on Day 2 (11 Aug) is probably not likely.

GEO Electron Environment	Level ($\text{cm}^{-2}\text{sr}^{-1}\text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2\text{ MeV}$ $\geq 1 \times 10^8$	No	30	30	30	30
Very Active	$\geq 2\text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1

Figure 5: REFM electron fluence – observations, forecast and recurrence.

